

U.S. Coast Guard Research and Development Center
1082 Shennecossett Road, Groton, CT 06340-6096

Report No. CG-D-18-00

**IN-SITU BURN INVESTIGATION: EXERCISE #1
GALVESTON, TEXAS**



**FINAL REPORT
JUNE 2000**



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National Technical Information Service, Springfield, VA 22161

Prepared for:

U.S. Department of Transportation
United States Coast Guard
Marine Safety and Environmental Protection (G-M)
Washington, DC 20593-0001

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Technical Report Documentation Page

1. Report No. CG-D-18-00		2. Government Accession Number		3. Recipient's Catalog No.	
4. Title and Subtitle In-Situ Burn Investigation: Exercise #1, Galveston, Texas				5. Report Date June 2000	
				6. Performing Organization Code Project No. 4120.5.1	
7. Author(s) Theodore E. Camlin				8. Performing Organization Report No. R&DC 492-00	
9. Performing Organization Name and Address Response Management Associates, Inc. 16000 Stuebner Airline Road, Suite 520 Spring, Texas 77379		U. S. Coast Guard Research and Development Center 1082 Shennecossett Road Groton, CT 06340-6096		10. Work Unit No. (TRAIS)	
				11. Contract or Grant No. DTCG39-99-C-E0040	
12. Sponsoring Organization Name and Address U.S. Department of Transportation United States Coast Guard Marine Safety and Environmental Protection (G-M) Washington, DC 20593-0001				13. Type of Report & Period Covered Final Report	
				14. Sponsoring Agency Code Commandant (G-MOR) U. S. Coast Guard Headquarters Washington, DC 20593-0001	
15. Supplementary Notes The U.S. Coast Guard Research & Development Center's technical point of contact is James W. Gynther, 860-441-2858; email: jgynther@rdc.uscg.mil, or Kenneth R. Bitting, 860-441-2733; email: kbitting@rdc.uscg.mil.					
16. Abstract (MAXIMUM 200 WORDS) In accordance with the National Oil and Hazardous Substances Pollution Contingency Plan, many Regional Response Teams (RRTs) throughout the country have established pre-approved zones for the In-Situ Burning (ISB) of oil. ISB is generally recognized as a potentially effective means of quickly removing large quantities of oil from the ocean surface to avert possible oil spill impacts to coastal beaches, marshes, and inland resources. However, for a variety of reasons, ISB is a seldom-used response technique, particularly within the offshore environment. Given this background, the U. S. Coast Guard was interested in more clearly understanding the factors that impact the actual use of ISB within one RRT pre-approved, offshore zone. The U. S. Coast Guard Research and Development Center, with assistance from the Texas General Land Office, the Marine Spill Response Corporation, and the National Response Corporation, has developed a multi-year project, which is designed to evaluate the feasibility of conducting ISB operations within an offshore Galveston, Texas, environment. It involves three field exercises, which are progressive in nature, in order to investigate thoroughly the critical aspects of a safe, efficient, and effective offshore ISB response. This report documents the data, findings, conclusions, and recommendations derived from the first of these three ISB field exercises, which focused on the trial implementation of three presently recognized ISB Operational Procedures.					
17. Key Words marine spills, in-situ burning, fire boom operations			18. Distribution Statement This document is available to the U.S. public through the National Technical Information Service, Springfield, VA 22161.		
19. Security Class (This Report) UNCLASSIFIED		20. Security Class (This Page) UNCLASSIFIED		21. No of Pages 48	22. Price

Form DOT F 1700.7 (8/72) Reproduction of form and completed page is authorized.

ACKNOWLEDGMENTS

The USCG Research and Development Center designed and conducted these at-sea exercises with the intent of developing a prototype In-Situ Burn (ISB) Operational Plan for the offshore Galveston, Texas area. The Project Team for these exercises included a wide variety of expertise and support from many different sources. Through the dedication and support of the participants acknowledged here, the Project Team was able to conduct an impressive set of tasks designed to evaluate the feasibility of specified operational procedures unique to ISB operations.

Marine Spill Response Corporation: The Marine Spill Response Corporation (MSRC) provided the 210-ft. vessel Texas Responder and the shore-based facilities for the exercise's daily morning safety and operational briefing.

National Response Corporation: The National Response Corporation (NRC) provided the 110-ft. vessel NRC Admiral, the 110-ft. vessel SEACOR Marine Ramona, and Unified Command oversight to planning, implementation, and evaluation activities.

USCG Gulf Strike Team: The Gulf Strike Team (GST) provided senior National Inter-Agency Incident Management System (NIIMS) Incident Command System (ICS) Operations Section personnel to direct the at-sea exercise activities. This included the Operations Section Chief, ISB Work Group Supervisor, Exercise Control Group Supervisor, and Helicopter Spotters. In addition, the GST provided its Mobile Communications van and the Communications Unit Leader to set up and maintain the exercise's numerous critical communications links.

USCG Eighth District: The USCG Eighth District provided important oversight to the Unified Command and the Liaison Officer and Logistics Section Chief levels. Additionally, the District was liaison to the Regional Response Team (RRT) regarding in-situ burn operations.

Texas General Land Office: The Texas General Land Office – Oil Spill Response Division (TGLO) provided personnel support at both the Unified Command and field levels of the NIIMS ICS organization and represented the State of Texas perspective. In addition, TGLO arranged for weather and current meter support via Texas A&M University at Galveston.

USCG Reserve Training Center-Yorktown: RTC-Yorktown provided the Pollution Incident Simulation, Control, and Evaluation System (PISCES) and the personnel to operate the system.

Commandant (G-MOR): Commandant (G-MOR), the USCG Headquarters Sponsor, offered a continual and important nationwide perspective for this investigation, and provided the Safety Officer for this exercise.

USCG Air Station – Houston: USCG Air Station – Houston provided the Air Operations Branch Director and one helicopter and its crew to assist in the aerial support activities.

USCG Marine Safety Unit – Galveston: USCG Marine Safety Unit – Galveston provided important guidance and support to the ISB Project Team. They also provided the Support Branch Director and the Medical Unit Leader.

Clean Channel Cooperative: The Clean Channel Cooperative provided their support to this project via their representative's guidance, encouragement, and participation as Deputy Safety Officer.

EXECUTIVE SUMMARY

Background

When a petroleum spill occurs in the marine environment, one of the response technologies usually considered for use, by the Incident Commander and his staff, is the burning of the petroleum product in-place on the water surface. Some of the Regional Response Teams (RRTs) throughout the country, which are multi-agency, contingency planning groups, have established zones where In-Situ Burning (ISB) is pre-approved as an accepted means for removing oil from the water and thereby averting potential oil spill impacts to coastal beaches, marshes, and in-land resources.

However, ISB is seldom used during actual responses, particularly within the offshore environment. Many factors contribute to this situation. They include, but are not limited to the lack of: (a) a detailed ISB Operational Plan for the specific RRT pre-approval zone, (b) sufficient ISB resources, both equipment and trained personnel, that can be mobilized within the limited ISB "window-of-opportunity," and (c) an understanding of and confidence in the intimidating *fire-based* ISB technology, including misconceptions relating to the costs and benefits that should be associated with the use of this technology.

Given this background, the Coast Guard was very interested in more clearly understanding the factors that impact the actual use of ISB within one RRT pre-approved offshore zone. As a result, the Coast Guard Research and Development Center (R&DC) assembled an experienced, public-private sector partnership team to evaluate the feasibility of conducting ISB operations within an offshore Galveston, Texas, environment. This ISB Project Team includes the following principal participating organizations: the Texas General Land Office, Marine Spill Response Corporation, National Response Corporation, and Coast Guard Research and Development Center.

This ISB Project Team has developed, and is now implementing, a multi-year plan, in which a series of three increasingly complex ISB exercises will be conducted within an ISB pre-approved zone, located 3 to 5 nautical miles (nm) off the Galveston, Texas coast.

ISB Project Goal

The goal of this project is to investigate the viability of ISB by striving to make it a "True Operational Tool" for offshore responses, within one USCG-selected response area, by 2002.

ISB Exercise #1

This report describes the planning, conduct, and results of the first ISB exercise (referred to as Exercise #1 in this report), conducted by the ISB Project Team off Galveston, Texas during April 1999. This exercise involved five vessels, two helicopters, and over fifty people in the conduct and collection of data on promising operational procedures for the containment of floating oil at-sea, as a prelude to burning it effectively. One of the on-scene helicopters provided a real-time video link to the shore-based Exercise Control Center (ECC). Since actual oil could not be

spilled and utilized during this exercise, more than four tons of oranges were used as the "target spilletts" (i.e., segments of oil) for testing the promising operational procedures.

Exercise Objective

The primary exercise objective was to investigate the safe, effective, and efficient implementation of promising ISB Vessel-Fire Boom Operational Procedures, offshore of Galveston, Texas.

Conclusions

The overarching strategy for this project is to develop ISB procedures by conducting three exercises that build on the results and experiences of the previous ones. The results of this exercise have been analyzed and will be incorporated into the plan for Exercise #2. The conclusions are as follows:

1. Galveston ISB Planners should anticipate a minimum time-lag of 6 to 10 hours from Order/Activation to ISB Work Group On-Scene Ready for ISB Operations for an offshore spill, located within a 16-nm transit distance from the Tesoro Facility.
2. Galveston ISB Planners should consider the Independent Task Force Operational Procedure as a lower-priority ISB response tactic for offshore spills. The Independent Task Force Operational Procedure involves pairs of vessels with fire boom, acquiring and towing a spillet from the slick to a safe burn area for burning, without the assistance of any other vessels.
3. All ISB Planners should continue to consider the Coordinated Task Force Operational Procedure as a potentially promising ISB response tactic for offshore spills. The Coordinated Task Force Operational Procedure involves pairs of vessels with conventional boom, acquiring and towing a spillet from the slick to a safe burn area, where it is transferred to a pair of vessels with fire boom for the actual burning.
4. Exercises, such as ISB Exercise #1, are an excellent tool for acquiring and building consensus and USCG/State/Industry understanding of the strengths and weaknesses of ISB within the offshore environment.

Recommendations

The following recommendations are made for planning Exercise # 2:

1. Continue to analyze the Coordinated Task Force Operational Procedure during future ISB exercises. Specific focus should be on the J-Release versus Towline Release questions and Return Sprint technique issues. These are the time-consuming elements of the work cycle for the task forces delivering oil to the task force actually burning it.

2. During the next ISB exercise, the investigation of the Funnel Operational Procedure should be given a high priority. This is a procedure in which a very wide-mouth boom configuration is used to drastically increase the oil encountered.
3. Future ISB exercises should utilize *actual fire boom* in order to fully understand its operational requirements and increase the validity of exercise findings.
4. Future ISB exercises should build on the ISB Project Team relationships and Lessons Learned from this exercise. Specifically, they should continue to use:
 - NIIMS ICS for ISB Exercise Management
 - The Hilton Hotel Exercise Control Facility
 - The Tesoro Facility as the ISB Staging Area
 - Oranges as the target spilllets (if oil cannot be used).

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LIST OF ABBREVIATIONS AND ACRONYMS

CRADA	Cooperative Research and Development Agreement
ECC	Exercise Control Center
GPS	Global Positioning System
GST	Gulf Strike Team
IAP	Incident Action Plan
ICS	Incident Command System
ISB	In-Situ Burning
MSRC	Marine Spill Response Corporation
NIIMS	National Interagency Incident Management System
nm	Nautical Mile
NRC	National Response Corporation
OSC	Operations Section Chief
PISCES	Pollution Incident Simulation, Control, and Evaluation System
RDC	Research and Development Center
RRT	Regional Response Team
RTC	Reserve Training Center
TF	Task Force
TGLO	Texas General Land Office
USCG	United States Coast Guard

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1 INTRODUCTION

1.1. BACKGROUND

In-Situ Burning (ISB) appears to have the potential to safely eliminate large amounts of oil from a marine environment in a short time period. Successful pilot tests and previous experimental controlled burns have demonstrated the feasibility of collecting oil in fire-resistant containment booms and then igniting the oil (Walton, 1998). Conducting ISB operations in concert with more conventional mechanical recovery operations may have the potential to improve the effectiveness of the overall response operations within various scenarios. Response managers should always strive to find the most effective and efficient blend of equipment, methodology, and personnel for the protection of the environment.

1.2. OVERALL PROJECT GOAL

The primary project goal is to investigate the viability of ISB by striving to make it a true operational tool for offshore spill responses, within one USCG-selected response area, by Year 2002. A Regional Response Team (RRT) pre-approved zone offshore from Galveston, Texas currently allows the predesignated Federal On-scene Coordinator to approve of ISB operations in the event of a spill. With the exception of exclusion zones, the pre-approved zone is located 3 nautical miles (nm) or more offshore of the Texas and Louisiana shorelines. This exercise was designed to evaluate several currently recognized ISB vessel-fire boom operational procedures within a potential offshore Galveston, Texas scenario. The exercise was conducted with the cooperative effort of several key partners.

1.3. CRADA PARTNERS

The United States Coast Guard Research and Development Center (R&DC) has implemented a Cooperative Research and Development Agreement (CRADA) in order to accomplish the overall project goal. The contributing partners assembled by the R&DC are listed below:

- Texas General Land Office – Oil Spill Response Division
- Marine Spill Response Corporation
- National Response Corporation
- United States Coast Guard Research and Development Center

1.4. NIIMS INCIDENT COMMAND SYSTEM

The National Interagency Incident Management System (NIIMS) Incident Command System (ICS) is now being used by a majority of the marine spill response community to organize their response to spill “incidents.” NIIMS ICS was the method selected to organize the design and conduct of this exercise.

As a result of its organizational vocabulary and paradigms, NIIMS ICS is understood by a majority of the exercise participants based on their marine spill response experience. It also appeared to be an effective mechanism for blending the diverse resources needed to design the ISB exercises and properly manage their exercise development process. Additionally, the NIIMS ICS appeared to provide the organizational structure (i.e., unity and chain of command, span of control) needed to conduct the ISB exercises. The exercise operations required two basic elements to be organized and managed simultaneously for the safe implementation of the developed exercise plans. The first element was dedicated to the control, direction, and management of the exercise support tasks (e.g., target spilllet release and retrieval, data collection). The second element was the direction and control of the ISB operational tasks (e.g., ISB spilllet preparation).

2. IN-SITU BURN EXERCISE #1 OBJECTIVE

2.1. OVERALL EXERCISE OBJECTIVE

The primary exercise objective was to investigate the safe, effective, and efficient implementation of promising ISB Vessel-Fire Boom Operational Procedures within a potential offshore Galveston, Texas, scenario. The investigation was conducted in cooperation with the CRADA partners identified in section 1.3.

2.2. EXERCISE ISSUES

(a) Response Time Analysis

- Provide empirical insight into the time required to assemble an ISB Work Group within the pre-approved ISB zone off Galveston, Texas.
- Provide empirical insight into the times required to accomplish the work cycles associated with several alternative ISB operational procedures for offshore spillet preparation.

(b) Operational Viability

- Provide operational insight into the overall viability of several alternative ISB operational procedures for offshore spillet preparation.
- Provide operational insight into the problems associated with alternative vessel size pairs, within ISB Task Forces, for offshore spillet preparation operations.
- Provide operational insight into the use of NIIMS ICS for offshore ISB spillet preparation operations.
- Provide operational insight into the design of a recommended Communications Plan for offshore ISB spillet preparation operations.

3. EXERCISE APPROACH

3.1. OVERVIEW

3.1.1. Exercise Area

The exercise area selected for the At-Sea Area of Operations is immediately outside the 3-mile demarcation line identified in the Region VI In-Situ Burn Plan (U.S. Coast Guard, 1994). The rectangular exercise box runs parallel to the Galveston Island beach. The exercise box (Figure 1) is approximately 6 nm long x 3 nm wide. The designated exercise box is marked at the corners as follows:

A: N29° 12.5' W94° 48.4' B: N29° 15.6' W94° 43.8'
C: N29° 13.5' W94° 41.6' D: N29° 10.1' W94° 46.5'

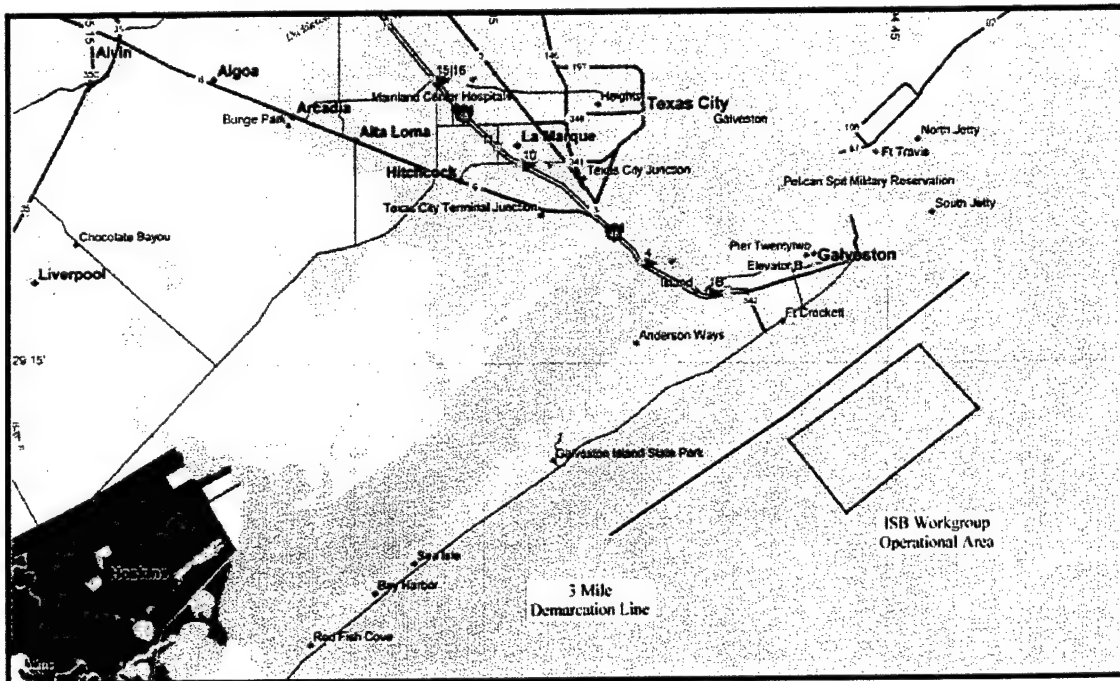


Figure 1. Exercise area.

3.1.2. Exercise Control Center

The Exercise Control Center (ECC) for ISB Exercise #1 was located inside the Hotel Conference Facility (Figure 2) at the Galveston Island Hilton Hotel for the duration of the exercise.

The U. S. Coast Guard Gulf Strike Team (GST) communications trailer was located immediately outside the Conference Center. Radio transmit and receive towers were installed on the roof of the hotel.

The ECC was organized using a layout similar to an Operational Incident Command Post that would typically be assembled for the conduct of operations during an actual response incident.

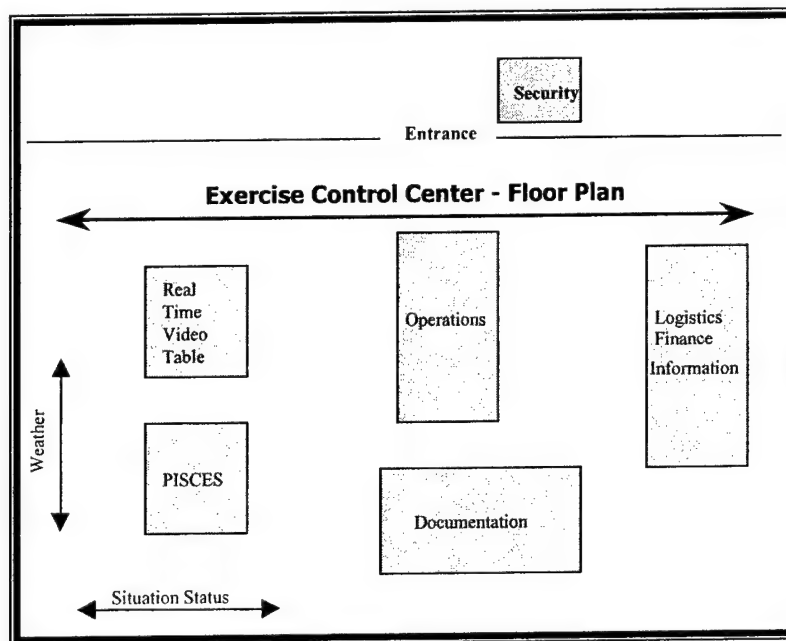


Figure 2. Exercise Control Center inside Conference Facility.

Additional components of the ECC included the downlink component for the real-time video tracking, the PISCES data collection and recording, and the GST Communications Trailer.

3.1.3. ISB Work Group Resources

(a) Task Force #1

Task Force #1 (TF #1) was comprised of assets provided by the Marine Spill Response Corporation including the Vessel Texas Responder and crew, the 32-ft. Munson Tow Boat and crew, and 660-ft. of Ocean Boom and related support and communications equipment. Table 1 presents general specifications of TF #1, which was assembled to identify potential problems (or advantages) associated with using different-sized vessels for towing boom during ISB operations.

Table 1. Task Force #1 data.

Task Force # 1						
Vessel Name	Vessel Size Length –Draft – Width (ft)			Power Plant (hp)	Transmission Data	Crew/ Berthing
Texas Responder	210	14	45	3000	<ul style="list-style-type: none"> • Slip-Mode Gear Reduction • Twin Screw 	6 Crew 32 Berth
Munson	32	4.5	12.8	600	<ul style="list-style-type: none"> • Slip-Mode Gear Reduction • Twin Screw 	2 Crew 10 Berth

(b) Task Force #2

Task Force #2 (TF #2) was comprised of assets provided by the National Response Corporation (NRC) including the Vessels NRC Admiral and the Ramona G and full crews, and 550-ft. of 43-in. oil stop Ocean Boom and related support and communications equipment. Table 2 presents the general specifications of TF #2, which was assembled to identify potential problems (or advantages) associated with using same-sized vessels for towing boom during ISB operations.

Table 2. Task Force #2 data.

Task Force #2						
Vessel Name	Vessel Size Length –Draft – Width (ft)			Power Plant (hp)	Transmission Data	Crew/ Berthing
NRC Admiral	110	9	26	1200	<ul style="list-style-type: none"> • Slip-Mode Gear Reduction • Twin Screw 	4 Crew 20 Berth
M/V Ramona G	110	9	26	1200	<ul style="list-style-type: none"> • Slip-Mode Gear Reduction • Twin Screw 	4 Crew 20 Berth

(c) Air Assets

Air assets utilized for this exercise were comprised of two platforms. The first platform (primary), a Bell Jet Ranger 206B3 Helicopter was contracted to provide real-time video link of the exercise operations from the exercise area to the ECC. The USCG Air Station Houston provided the second platform helicopter, an HH-65A. This resource was utilized during the segments of the exercise day during which the primary platform was released to refuel and pilot rest. Both the primary and secondary platforms had on-board spotters provided by the GST. Table 3 presents specifications for the two platforms.

Table 3. Air asset data.

Item	Bell Jet Ranger 206B3	USCG HH-65A - Helicopter
Length (tip of rotor to tail)	39 ft. - 1 in.	44 ft. - 5 in.
Height (to top of rotor head)	9 ft. - 7.5 in.	12 ft. - 9 in.
Width	6 ft. - 4 in. (skids)	10 ft. - 6 in. (at stabilizer)
Cargo Loading: (cabin)	40 cubic ft.	176 cubic ft.
(baggage compartment)	16 cubic ft.	88 cubic ft.
Emergency Floatation	Installed	Installed
Rescue Hoist	Not Applicable	Max. Permissible Load 600 lbs.
Cargo Hook Limitations	Not Applicable	Max. Permissible Load 2,000 lbs.
Maximum Gross Weight	3200 lbs	9200 lbs
Endurance	<u>Single Engine</u> 3.0 hr. (range extender) 2.5 hr. normal operations	<u>Twin Engine</u> 3.5 hr. of operation
Range	Varies with work effort	Approximately 150 miles
ISB Ex #1 Crew/Passengers	1 / 2	3 / 2

The real-time video link consisted of two components: a mounted remote-controlled video recording equipment and a microwave transmission-reception between the helicopter and antenna mounted on the roof of the hotel. The ECC had a 27-in. monitor and VHS recording deck for viewing and archiving.

3.1.4. Exercise Target Spillet Logistics

The exercise performance was designed to evaluate the ability of the task forces to accomplish certain tasks and to measure the time consumed during each task evolution. Three tasks were designed for this purpose. A fishing vessel was the dedicated platform assigned to deploy the "targets" used in this exercise. The selected targets were fluorescent green dye (for the first

target delivery to both task forces) and oranges for subsequent target deliveries to the task forces. All target deliveries were directed and coordinated by the Operations Section Chief (OSC).

3.1.5. Exercise Organization

The design of the exercise organization was based on the NIIMS Incident Command System (ICS), including the five functional areas (i.e., command, operations, planning, logistics, and finance). NIIMS ICS provided the basis of the personnel organization assembled in the command center, and all functional areas were staffed (as necessary) for this exercise. During the course of the exercise, the operations functional area was organized to provide safe and effective management of the designated exercise tasks and continuous improvement and adjustment of the planned events.

The Operations Section was comprised of the OSC, Deputy, and three operational branches.

Branch I was responsible for exercise control, Branch II was responsible for the implementation of exercise operations (as directed), and Branch III was responsible for the airborne platforms performing spotter and video operations.

3.1.6. Exercise Schedule

The exercise was scheduled for the week of 19 April 1999. Monday was set aside as the final preparation and initial exercise briefing day, Tuesday and Wednesday were set aside as the operational days, with Thursday as the contingency day. Friday, 23 April 1999, was set aside for debrief and demobilization. Friday's activities would replace Thursday's scheduled activities in the event the exercise concluded with Wednesday's activities. Figure 3 presents the day-by-day work schedule.

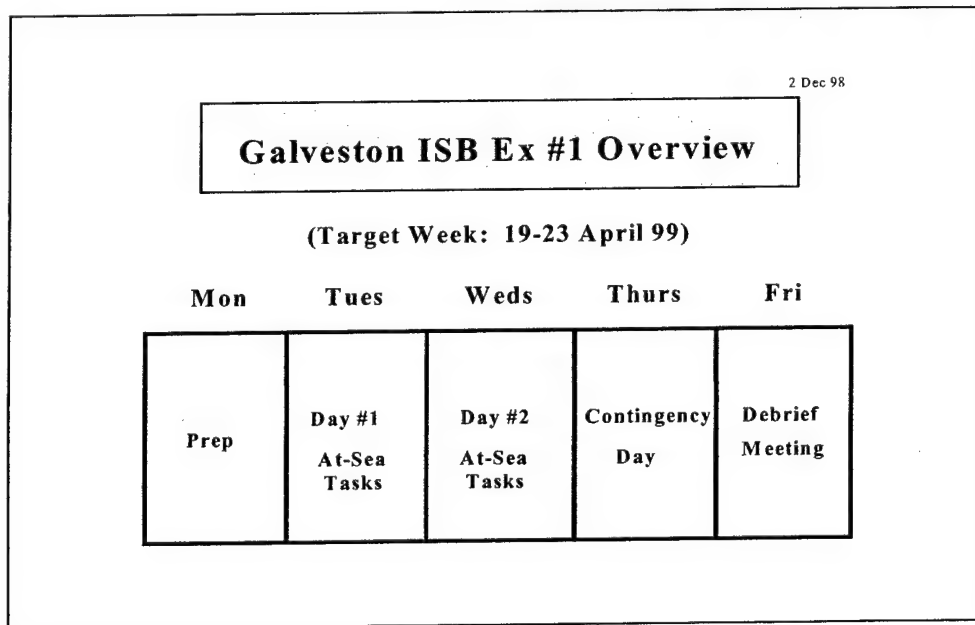


Figure 3. Exercise work schedule.

Adverse weather conditions forced the conclusion of exercise operations on Wednesday. Therefore, debrief and final demobilization was conducted on Thursday instead of Friday.

3.1.7. Exercise Incident Action Plans

Incident Action Plans (IAPs) were developed, using standard NIIMS forms, for each day's operational periods. IAPs spell out the operational organizational structure, the primary objectives (strategic and tactical), the assignment of resources (personnel and equipment), and the methods to be used to meet the objectives. The Unified Command developed and approved the IAP activities scheduled for each day of the exercise.

3.2. AT-SEA ISB OPERATIONAL TASKS

3.2.1. Task #1

At-Sea Task #1 is designed to establish a realistic timeline for all elements of the exercise. Specific considerations include:

1. Time to load and rig ISB hardware aboard the vessels
2. Estimated time underway versus actual time underway
3. Time ISB vessels arrive on scene at the designated exercise area
4. Estimated time of arrival versus actual time of arrival
5. Effectiveness of the "U" configuration and time management measurements regarding time to assemble (should improve over course of the exercise)
6. Ability to maintain "U" configuration in a stationary mode or while maneuvering
7. Documentation of deployment and operational difficulties.

3.2.2. Task #2 – Independent Task Force Operations

At-Sea Task #2 is designed to have TF #1 and TF #2 operate simultaneously from both sides of the simulated slick with no interaction with the other task force. In this scenario, both TF #1 and TF #2 would be performing oil collection/burning operations. TF #1 uses vessels of different sizes, while TF #2 is comprised of vessels of similar size. This configuration allows the project team to evaluate potential operational variances between TF #1 and TF #2 (see Figure 4).

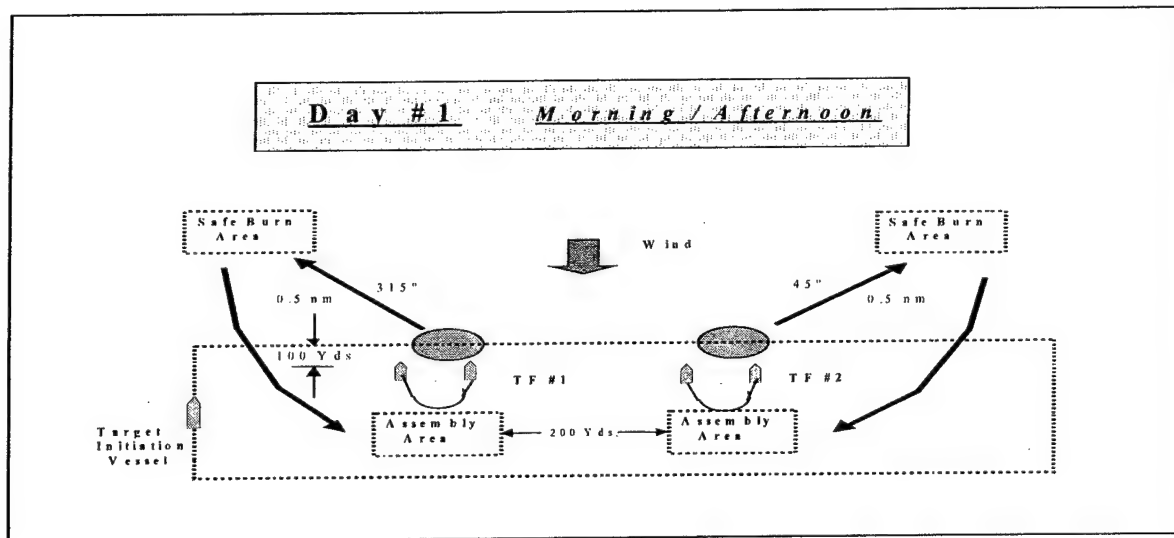


Figure 4. Independent task force operational procedure.

3.2.3. Task #3 – Coordinated Task Force Operations

At-Sea Task #3 is designed to have TF #1 act as the dedicated burning task force and TF #2 will perform spillet collection and delivery operations. In this operational phase, TF #1 would maintain a stationary position in relation to the slick. The spotter helicopter would assist in directing TF #1 positioning. TF #2 will operate in a circular pattern while collecting oil from the slick, transporting the oil, and delivering the spillet to TF #1 for burning (see Figure 5). This Operational Procedure takes advantage of the fact that within a given port area, there may be substantial amounts of conventional boom, but only one fire boom. It also minimizes the movement, and hence, the mechanical stress on the fire boom, which is already undergoing substantial thermal stresses during the operation.

During Task #3, TF #1 will start as the dedicated burning task force for the operation and TF #2 as the designated collection and delivery task force for the operation. At the direction of the ISB Work Group Supervisor, roles will be reversed and TF #2 will become the dedicated burning task force and TF #1 will become the collection and delivery task force. This switch allows the project team to evaluate potential operational variances between TF #1 and TF #2 while they are in the different roles.

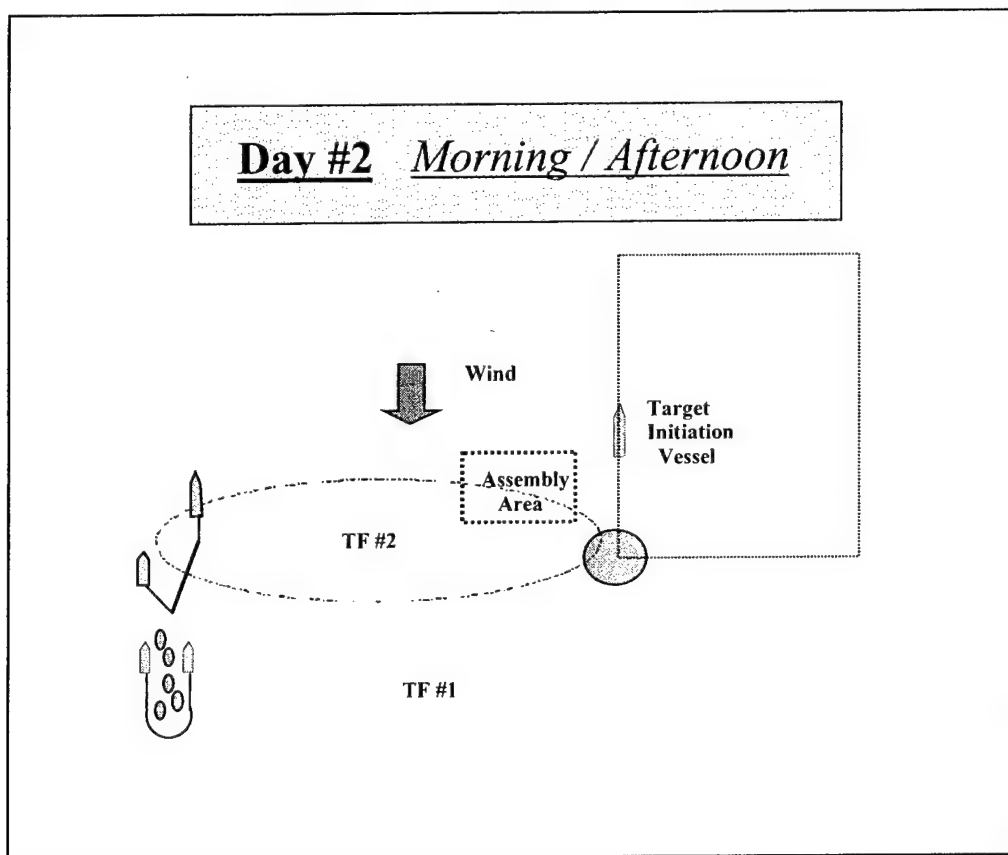


Figure 5. Coordinated task force operational procedure.

3.2.4. Task #4 – Funnel Operations

In At-Sea Task #4 (optional) of the operations, TF #2 will rig the funnel shape by using two 1000-ft. legs of ocean boom connected in the middle by a 50-ft. bridle assembly. Both vessels will maintain approximately 750 ft. of opening while maneuvering to acquire the target spill as directed by the ISB Work Group Supervisor or the helicopter spotter (see Figure 6). This task was postponed until ISB Exercise #2 due to adverse weather conditions. This Operational Procedure has the potential of concentrating oil from a substantially greater swath width than using the U-configuration fire boom by itself. This may be very advantageous within selected spill scenarios, particularly when the oil is widely dispersed and low encounter rates are a problem.

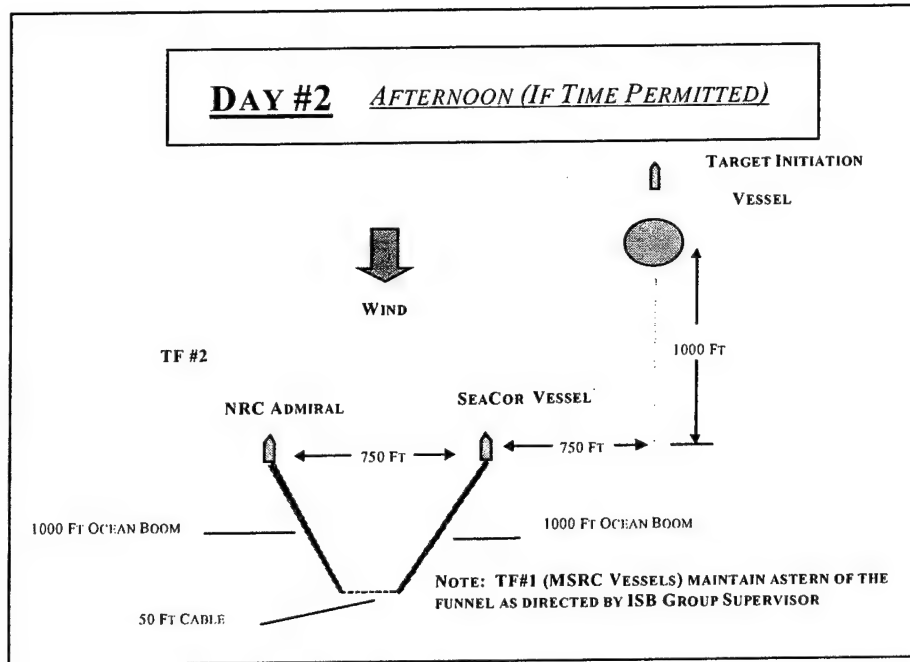


Figure 6. Funnel operational procedure.

3.3. RECORDING TOOLS

3.3.1 Current Meters

The Texas General Land Office (TGLO) provided and operated current measuring equipment for TF #1 and TF #2 throughout the duration of the exercise. The TGLO equipment provided continuous/real-time digital readout as an output mode for the current meter monitoring system. This output can be polled on a minute-by-minute basis during exercise operations. The data are computer logged and printed at the end of the exercise day. Speed-through-the-water current measurements are critical for this exercise because oil loss by entrainment under the boom typically occurs at approximately one-knot speed-through-the-water. If the task forces are allowed to perform their ISB maneuver at greater than 1 knot, a false impression of overall ISB performance would be obtained.

3.3.2 Real-Time Video

Real-time video was displayed and recorded during the exercise via continuous feed from the contract helicopter to the Exercise Command Center. The equipment used by the Contractor (Griffin Communications, Inc.) was typical of remote-operated (i.e., via the helicopter command pilot), gyro-stabilized, beta format video cameras commonly used by news media and television stations for reporting.

3.3.3 Other Video

The secondary aerial platform was a helicopter provided by Air Station Houston, which used a hand-held video camera to record exercise operations while conducting aerial monitoring operations when the primary platform was at the heliport for fueling and pilot rest periods. Additionally, personnel aboard the Vessel Texas Responder performed video monitoring of the field operations throughout the course of the exercise.

3.3.4 PISCES

The United States Coast Guard, Yorktown Reserve Training Center, set up and operated the Pollution Incident Simulation, Control, and Evaluation System (PISCES) throughout the course of the exercise operations. Global Positioning System (GPS) transmitters were placed on the five primary waterborne assets (vessels Texas Responder, Munson, NRC Admiral, Ramona G, and F/V Revenge) used during the course of the operations. PISCES has the capability to track the movement of the GPS transmitters and provide a plot of the resource movement throughout the course of the exercise.

3.3.5 Digital Nautical Charts

An additional (GPS) transmitter was also used on the vessel Texas Responder during the course of the exercise operations. This output was tracked as overlay on an electronic digital navigational chart (Chart ViewTM).

3.3.6 Data Recorders

Two individuals were assigned to be data recorders to monitor the exercise operations and to track specified data during the course of the exercise. TF #1 had an individual assigned as Data Recorder aboard the vessel Texas Responder, and TF #2 had an individual assigned as Data Recorder aboard the vessel NRC Admiral. These data recorders were tasked to ensure that all data forms were completed during the course of the exercise.

4. DATA/OBSERVATION SUMMARY

The field operations for Exercise #1, designed for a two-day period, were limited to one day of exercise due to weather. An IAP was assembled and approved for implementation by the Unified Command. The IAP for each operational period identified the personnel and equipment resources, the chain of command, and the specific operational objectives and tasks for each day of the exercise. Various personnel in the field and at the command post conducted data gathering. Specific data results are presented below.

4.1. AT-SEA TASKS

4.1.1. Weather

Prior to the initiation of each day's operational exercise, Texas A&M University provided weather updates for the participants at the 0600 Operations Briefing Meeting. During the course of the exercise, weather data were gathered on an hourly basis. Table 4 provides a weather summary for the exercise days.

Table 4. Exercise weather summary.

20 April 1999	Wind Direction (degrees)	Wind Speed (knots)	Sea State (ft.)	Coastal Currents (parallel coast)	Visibility (miles)
0800 – 1200	200	11 – 13	3.0 – 3.6	~2.03 knots North Easterly	6 – 10
1200 – 1400	200	11 – 13	3.3 – 3.6	~1.2 knots North Easterly	6 – 10
1400 – 1600	180	11 – 13	3.3 – 3.6	~0.4 knots North Easterly	6 – 10
On-scene weather report from TF #1 and TF #2 indicate no significant variance between the data provided by the sea buoy.					
21 April 1999	Wind Direction (degrees)	Wind Speed (knots)	Sea State (ft)	Coastal Currents (parallel coast)	Visibility (miles)
0800 – 1200	160	17 – 21	5.2 – 6	~1.94 knots North Easterly	4 – 8
TF #2- On-scene	SSE	23-24	9 – 13	Not Reported	

Source: NDBC BUOY 42035 – GALVESTON Latitude: 29° 14' 47" N Longitude 94° 24' 35" W

The weather on day two of the operation worsened appreciably so that conditions (e.g., sea state, wind speed) prevented safe operations, and the field exercises were concluded at 0900 hours on Wednesday, 21 April 1999.

4.1.2. Task #1 – ISB Work Group Deployment

Task #1 was designed to establish a realistic timeline for selected exercise elements. Start and end time tracking of certain elements must be understood in order to provide realistic time assumptions that will be used in the development of a practical ISB Operational Plan for near shore operations in the Galveston area. Task #1 of Exercise #1 identified five specific performance measures to be evaluated during the Response Time Analysis. These performance measures are listed below:

- (a) Time to load and rig ISB hardware aboard the vessels.
- This performance measure was established to provide a realistic evaluation of the time component needed to reconfigure TF #1 and TF #2 for ISB containment and burning operations in the near shore Galveston area.
 - This specific measure was not evaluated during the first exercise.
 - Current estimates of time consumed are provided in Table 5.

Table 5. Estimated ISB equipment deployment times.

Task Force	Time Estimate (Start – Lines Off)	Comments
TF # 1	+ 2.0 hr from notification	<ul style="list-style-type: none">• MSRC Assets• ISB Equipment on site• If assets are deployed, transport of ISB equipment to designated location is provided by vessel of opportunity.
TF # 2	+ 4.0 – 6.0 hr from notification	<ul style="list-style-type: none">• NRC Assets• ISB Equipment at TGLO LaPorte, TX• If assets are deployed, transport of ISB equipment to designated location provided by vessel of opportunity.

Sources: National Response Corporation
Marine Spill Response Corporation

- (b) Time vessels are underway.
- Exercise operations were scheduled to start at 0700 hr on each exercise day.
 - Both TF #1 and TF #2 were underway by 0715 hr on both days of the exercise.
- (c) Time ISB vessels arrive on scene (at the designated exercise area).
- Transit time to the designated area (a linear distance of approximately 16 nm) was approximately 2.0 hr for both TF #1 and TF #2.
 - 16 nm of linear travel in approximately 2.0 hr placed each task force in the SW corner of the exercise area approximately 6 nm offshore.
- (d) Time TF #1 and TF #2 are ready for ISB operations.
- Both TF #1 and TF #2 initiated equipment deployment at approximately 2.25 hr into the exercise. Equipment deployment and "U"-shaped configuration were achieved by both task forces approximately 3.75 hr into the exercise.
- (e) Documentation of deployment and operational difficulties.
- Deployment for both TF #1 and TF #2 proceeded normally during the Day One exercise.
 - The one exception, TF #1 experienced a short operational delay when the secondary tow vessel suffered a brief mechanical problem from approximately 1230 - 1250 hrs.
 - The Day Two exercise operation was not completed due to adverse weather conditions.
 - During the Day Two exercise, the F/V Revenge was not able to transit past the jetties. Unified Command modified the IAP to have the F/V Revenge and the Vessel Texas Responder tied up at "Anchorage A," and the target oranges were transferred (0745 - 0852 hr) from the F/V Revenge to the Vessel Texas Responder.
 - At 0854 hr, the Vessel NRC Admiral reported the aft deck awash in 8 to 12-ft seas in the exercise area (29° 14.75 N and 094° 42.29 W).

Table 7 summarizes the timeline information.

Critical ISB Work Group Times Summary of Milestones – Day 1		
Time		Event
0715		TF #1 & TF #2 Underway
0915		Time Vessels Arrive On Scene (at the designated exercise area)
0925		TF #1 & TF #2 initiate ISB equipment deployment
1045		TF #1 & TF #2 Ready for ISB Ops

Table 7. Critical ISB work group times.

4.1.3. Task #2 – Independent Task Force Operational Procedure

At-Sea Task #2 was designed to evaluate acquisition, transport, and burning operations with TF #1 and TF #2 operating on opposite sides of the “slick.”

Data documentation was developed from a variety of sources during the evolution of the exercise. Data gathering worksheets were developed for the recorder placed aboard TF #1 and TF #2, the Texas A&M/TGLO current meter operators, and the real-time video and tape delayed video recorders/spotters aboard the helicopters.

Tables 6 and 7 provide details (gathered during the implementation of Task #2) on the operational tasks for TF #1 and TF #2, respectively. The exercise team had the opportunity to practice this task with green dye as the target spilllet prior to accomplishing the task with oranges. Green dye, while less expensive and an excellent target for spilllet acquisition, disperses quickly into the water column. The green dye then passes under the boom as the task force attempts to move it to the safe burn area.

Table 6. Day One – Task #2 Data Sheet – TF #1.

Item	Data	Comments
Time of Target Release: 1) Oranges – 1248 hr	Time of Acquisition: 1) 1303 hrs	<ul style="list-style-type: none"> Data Recorders PISCES Munson down with mechanical problems from ~1230 hrs – 1250 hrs
Elapsed time to transit (with oranges) to the designated safe burn area.	Arrival @ 1346 Elapsed Time: ~43 min	<ul style="list-style-type: none"> Data recorder GPS Tracking Radio Report to ECP
Effectiveness of the “U” Configuration in containing the target during transit: Performance Standards: Task Force Formation <ul style="list-style-type: none"> Establish 150-200-ft swath width Acquisition & Transit <ul style="list-style-type: none"> Transit swath width ~150-200 ft Transit speed (< 1.0 knots) 	No appreciable loss of target Good gap, some fluctuation during transit.	<ul style="list-style-type: none"> Data Recorder Radio Communications Current Meter Outputs Real-Time Video
Speed through water during transit (knots) (Max/Min/Mean)	Max. speed ~3.5 knots Min. speed ~0.1 knots Mean speed ~0.8 knots % Time > 1.0 knots = ~26% of recorded time.	<ul style="list-style-type: none"> Current Meter Data Current meter in the water ~86% of the exercise time.
Effectiveness of “U” Configuration during simulated burn <u>Performance Standard(s)</u> Maneuvers in Safe Burn Area: Turn into wind Concentrate Oil Min. entrainment Narrow gap to ~80 ft Maintain shape -5 min. Increase Burn Area Min. entrainment Widen gap to ~200 ft Maintain shape -5 min Shift Hot Spot Shift to left 1/3 of fire Boom Maintain 5 min Shift back to center	Tasks accomplished during practice between 1200 and 1214 hrs <hr/> <ul style="list-style-type: none"> Maneuvers conducted during helo refueling. Not all scheduled maneuvers were conducted during this time. IAP was adjusted to allow for potential weather considerations. ✓ Concentrate Oil ✓ Shift Hot Spot ✓ Increase Burn Area The above activities were completed	<ul style="list-style-type: none"> Time management data from the current meter printout(s) Visual captured from the real time video

Item	Data	Comments
Maintain ~200 ft gap Decrease Burn Area Min. entrainment Narrow gap to ~80 ft Extinguish Burn Maintain gap ~80 ft Increase speed to >1.0 Knots		
Time to acquire next target spillet	<i>Unified Command Moved on to Task #3</i>	

Table 7. Day One – Task #2 Data Sheet – TF #2.

Item	Data	Comments
Time of Target Release: 1) Oranges 1258	Time of Acquisition: 1) 1306 hr	<ul style="list-style-type: none"> Data Recorders PISCES Current Meters
Elapsed time to transit (with oranges) to the designated safe burn area.	Arrival @ 1320 hr Elapsed Time: ~14 min. Est. Dist. Is << 0.5 nm	<ul style="list-style-type: none"> Data recorder GPS Tracking Radio Report to ECC Current Meter Data
Effectiveness of the "U" Configuration in containing the target during transit: <u>Performance Standards:</u> Task Force Formation <ul style="list-style-type: none"> Establish 150-200-ft swath width Acquisition & Transit <ul style="list-style-type: none"> Transit swath width ~150-200 ft Transit speed (< 1.0 knots) 	Target loss estimated to be slight during this phase of operations. Gap estimated to be 50-ft with moderate fluctuation during transit. Transit speed estimated to be ~1.2 knots/ ships instrumentation	<ul style="list-style-type: none"> Data Recorder Radio Communications Current Meter Outputs Real-Time Video
Speed through water during transit (knots) (Max/Min/Mean)	Max. speed ~4.0 knots Min. speed ~0.8 knots Mean speed ~1.7 knots % time > 1.0 knots. = 81%	<ul style="list-style-type: none"> Current Meter Data Current meter in the water ~100% of the exercise time.
Effectiveness of "U" Configuration during simulated burn <u>Performance Standard(s)</u> Maneuvers in Safe Burn Area: Turn into wind Concentrate Oil Min. entrainment Narrow gap to ~80 ft Maintain shape -5 min. Increase Burn Area Min. entrainment Widen gap to ~200 ft Maintain shape -5 min Shift Hot Spot Shift to left 1/3 of fire Boom Maintain 5 min Shift back to center Maintain ~200-ft gap Decrease Burn Area	Estimated loss of "target" is not applicable during this phase. W/dye @1045 hr 1120 hr ✓ 1125 hr ✓ ✓ 1200 hr 1209 hr 1214 hr 1219 hr	<ul style="list-style-type: none"> Time management data from the current meter printout(s) and Data Recorder. Visual captured from the real-time video Maneuvers initiated prior arrival at the safe burn area @ 1149 hr

Item	Data	Comments
Min. entrainment	✓	
Narrow gap to ~80 ft		
Extinguish Burn	1222 hr	
Maintain gap ~80 ft		
Increase speed to >1.0 knots	1226 hr 1229 hr	
Time to acquire next target spillet	<i>Unified Command Moved on to Task #3</i>	

4.1.4. Task #3– Coordinated Task Force Operational Procedure

Task #3 was designed to evaluate operational viability and time requirements when one task force is designated as the burn unit and the other task force is designated as the collection and delivery unit.

Task #3 designates TF #1 as the burning unit, while TF #2 operates as the gathering and delivering unit for the operations.

During the course of the exercise, data indicate that it took approximately 75 to 90 minutes for TF #2 to collect, transport, and deliver the target to TF #1. Table 8 summarizes the data.

Table 8. Day One – Task #3 Data Sheet – TF #1 and TF #2.

Item	Data	Comments
SORTIE ONE		
TF #2 acquisition of spillet	<p>Time:</p> <ul style="list-style-type: none"> 1332 hr. – TF #2 acquires target spillet. 1405 hr. – TF #2 arrives on scene with TF #1. 1420 hr. – TF #2 acquires additional spillet. TF #1 & TF #2 align. <p>General Comments</p> <ul style="list-style-type: none"> Some entrainment by TF #2 during maneuvering. Entrainment appears to be at boom connector. Target vessel dropped spillet too close (200 ft.) to TF #2, only captured ¾ of spillet. <p>Current Meter (while spillet in boom):</p> <ul style="list-style-type: none"> TF #2 Maximum: ~2.9 knots TF #2 Minimum: ~0.1 knots 	<ul style="list-style-type: none"> Real-Time Video Spotter Data Data Recorders PISCES Current Meters

Item	Data	Comments
Effectiveness of transfer of target spillet from TF #2 to TF #1 (maneuver from "U" configuration to "J" configuration). Maneuver from "U" Configuration to drop towline mode.	Time: <ul style="list-style-type: none"> 1433 - TF #2 commence U to J. 1442 - TF #2 secondary vessel ~500-ft astern primary vessel. 1445 - TF #2 commence J dump. 1500 - TF #1 captured 1/3 of TF #2 J dump. General Comments: <ul style="list-style-type: none"> U to J drop towline maneuver curtailed due to IAP adjustment. TF #1 missed 2/3 of TF #2 J dump due to close maneuvering difficulty. Current Meter (while spillet in boom): <ul style="list-style-type: none"> TF #2 Maximum: ~2.5 knots TF #2 Minimum: ~0.8 knots 	<ul style="list-style-type: none"> Data Recorder Radio Communications Current Meter Outputs Real-Time Video
Effectiveness of the TF #1 "U" configuration in containing the target during simulated burn.	General Comments: <ul style="list-style-type: none"> Some entrainment TF #1 while lining up w/ TF #2 for "J" dump. Some oranges missed by TF #2 picked up by TF #1. 	<ul style="list-style-type: none"> Data recorder GPS Tracking Radio Report to ECC Current Meter Data
SORTIE TWO		
Time TF #2 to acquire next target spillet : Configuration Mode <ul style="list-style-type: none"> Maneuver to transport configuration (drop tow line mode) Transit Time Reassembly and acquisition time 	Time: <ul style="list-style-type: none"> 1448 - TF #2 enroute to acquire next spillet. 1456 - Target vessel released spillet. 1505 - TF #2 acquires spillet. 1505 to 1530 - TF #1 & TF #2 align. 1530 - TF #2 commence U to J. 1539 - TF #2 commence J dump. 1550 - TF #1 acquires spillet from TF #2 J dump. 1545 - TF #2 ordered to stand down and secure boom. General Comments: <ul style="list-style-type: none"> U to J drop towline maneuver curtailed due to IAP adjustment. Current Meter (while spillet in boom): <ul style="list-style-type: none"> TF #2 Maximum: ~2.4 knots TF #2 Minimum: ~0.1 knots TF #1 Maximum: ~1.7 knots TF #1 Minimum: ~0.1 knots 	<ul style="list-style-type: none"> Data Recorder Radio Communications Current Meter Outputs Real-Time Video
FINAL RELEASE TO RETRIEVAL VESSEL		
IAP modified for TF #1 to perform J dump.	Time: <ul style="list-style-type: none"> 1552 - TF #1 commence U to J. 1600 - TF #1 commence J dump. 1604 - TF #1 secondary vessel releases boom. 1610 - TF #1 commence boom retrieval. 1630 - TF #1 complete boom retrieval. 1642 - TF #1 complete secondary vessel (Munson) retrieval. 1810 - TF #1 dock side. Current Meter (while spillet in boom): <ul style="list-style-type: none"> TF #1 Maximum: ~1.8 knots TF #1 Minimum: ~0.3 knots 	<ul style="list-style-type: none"> Data Recorder Radio Communications Current Meter Outputs Real-Time Video

4.1.5. Task #4 – Funnel Operational Procedure

Task #4 was not completed during this first exercise because of the wind conditions and sea states observed within the exercise area. Conditions at the time were as follows:

- Wind speed was predicted to be 17 to 21 knots and was observed (near the exercise area) to be approximately 23 to 24 knots.
- The seas were expected to achieve 6 ft in the exercise area and were observed to be 6 to 8-ft waves on top of 3-ft swells.

Task #4 would have modified Task #3 to take advantage of additional containment boom assets. In this scenario, TF #2 would use the boom funnel shape to provide a continuous feed of more concentrated oil, separated from the slick, to TF #1. TF #1 would initiate simulated burning operations with the assistance of the field spotters.

4.2. OVERALL EXERCISE

4.2.1. Exercise Plan

The overall exercise plan was set up to implement two full days of field exercises, and to conduct the follow-up evaluation and demobilization of the specific elements.

- NIIMS ICS Event Planning served as the organizational foundation for the planning and exercise design.
- By using the familiar NIIMS organizational structure in the planning and development phases of the project, the project team was able to quickly identify the personnel resource needs of the exercise planning organization.

Additionally, extensive use of electronic mail facilitated cost-effective development, streamlined time management for the planners, and provided a quick review of the proposed operational procedures.

4.2.2. Exercise Implementation

Exercise implementation was streamlined by the use of NIIMS ICS in both the Event Planning and Exercise Implementation Stages.

- Key personnel utilized in the Event Planning Stage were slotted to participate in similar roles during the Implementation Stage; therefore, transition was easily accommodated.

- The exercise was laid out during the Event Planning Stage to encompass five days; specifics of this aspect have already been discussed.

While the schedule provided for a contingency day on Thursday, weather deteriorated early in the exercise week. Although the Planning Section and resources at Texas A&M University watched weather conditions closely, it quickly became clear that the weather would not improve, and it became necessary to modify the IAPs.

During an early afternoon meeting, the Unified Command evaluated the probabilities, and determined it prudent to make modifications to the existing work plan. Modifications discussed were for the ISB Work Group to remain on location in the designated exercise area past the scheduled operational time limit set for the day. By remaining in the exercise area for the additional time, the ISB Work Group was able to complete Task #3, originally scheduled for Day Two.

Once the change was decided and approved by the Unified Command, the adjusted tasking was implemented safely, quickly, and without a significant use of additional time.

5. FINDINGS

5.1. TASK #1 – ISB WORK GROUP DEPLOYMENT

5.1.1. Time to Load and Rig ISB Hardware

Exercise participants estimated the time to load and rig ISB hardware aboard ISB Work Group Vessels to be two to six hours. During the Exercise #1 planning process, the ISB Project Team decided to use traditional boom versus fire boom. Therefore, the data provided (by CRADA partners) are the estimated transport, load, and lash time for TF #1 and TF #2 to get specific fire boom resources aboard the MSRC Vessels Texas Responder and NRC Admiral, respectively. The decision to use traditional boom for this first ISB Exercise was based on the following factors:

- the desire by both MSRC and TGLO, who have fire boom in the Galveston area, not to incur possible repair/replacement costs to their existing fire booms (which are supposedly prone to becoming water-logged during use and suffering mechanical damage during launch and recovery);
- the USCG's Project funding constraints (which would not allow the procurement of a dedicated fire boom for the exercise); and
- the number of exercise issues that could be successfully investigated using conventional boom as a surrogate for fire boom.

It should be noted that the two-hour estimate above is based on MSRC's estimate of the time required to:

- Move the reel containing the fire boom from their Tesoro Facility Warehouse to the Vessel Texas Responder,
- Load the reel on board via an appropriate crane, and
- Secure the reel aft of the installed conventional boom reel.

The 6-hour estimate above is based on NRC's estimate of the time required to:

- Prepare the Vessel NRC Admiral for receipt of the TGLO fire boom,
- Transit the TGLO fire boom from the La Porte, Texas, storage yard to the staging area at Tesoro, and
- Load the TGLO fire boom onto the Vessel NRC Admiral's reel.

5.1.2. Time of ISB Work Group Arrival On-Scene

The time of ISB Work Group arrival on-scene from the Tesoro Facility to the designated ISB location, 6 nm offshore (i.e., 16 nm from the Tesoro facility), was approximately two hours. TF #1 and TF #2 were away from the Tesoro Facility by 0715 hours and at the designated assembly location by approximately 0915 hours. The straight-line path indicated that the transit distance (over the water transit route) to the designated exercise area was approximately 16 nm from the Tesoro Facility. The average speed of each task force was approximately 8 knots.

If the designated ISB Operations Area involves a greater transit distance from the Tesoro Facility, the required time must be increased appropriately via dead-reckoning techniques.

5.1.3. Time ISB Work Group Ready-for-ISB Operations

The ISB Work Group was ready for ISB operations approximately 1.75 hours after arrival on-scene (or 3.75 hours after departure from the Tesoro Facility). Upon arrival at the exercise area, each of the respective task forces began the equipment deployment process. Both task forces took just under two hours, from the start of deployment operations to completion, in order to be ready to safely begin the exercise operations. For TF #1, this involved the deployment of 660 ft. of 67-in. Sea Sentry Ocean Boom. For TF #2, this involved the deployment of 550 ft. of 43-in. Ocean Boom.

5.2. TASK #1 – INDEPENDENT TASK FORCE OPERATIONAL PROCEDURE

When transiting with an enclosed target spillet, under the ISB Exercise #1 conditions encountered, both task forces had difficulty keeping their “boom tow speeds” to less than 1.0 knot (speed through the water).

The research literature and at-sea experience of the CRADA partners indicate that entrainment of the contained oil will begin at approximately 1.0 knot of boom speed through the water. Therefore, each task force was instructed to keep their speeds below 1.0 knot during oil transit maneuvers. Task #2 was designed to investigate the capabilities of these task forces to maintain their relative speeds below 1.0 knot during transit maneuvers. Based on the current meter data collected during the transit operations, it appears that this task was difficult for both task forces.

This finding does not mean that both task forces would be unsuccessful in transporting oil during this ISB maneuver. Rather, it indicates that there may be some loss of oil during transit to the safe burn area. The amounts of oil lost would vary based on many factors, including oil type, boom type, sea state, etc.

Finding: ISB Work Group must be provided with additional time and flexibility to analyze and set up their ISB Operations relative to the actual on-scene wind and current.

During post-exercise discussions, task force personnel indicated that they felt constrained by the Exercise IAP, which instructed them to always set-up and conduct these ISB Operations “into the wind.” Certain conditions, such as oblique seas and/or coastal currents, may indicate another preferred orientation to the wind. On further analysis and discussion, the ISB Project Team believes that this exercise indicates that, after arrival at the designated ISB Operations area, the

task forces should take about 15 minutes to evaluate the actual on-scene wind and currents. Based on this on-scene evaluation and in coordination with the Operations Section Chief, the ISB Work Group Supervisor can make needed modifications and/or adjustments to the IAP.

Finding: Both task forces appeared to have no problem with the maneuvers within the Safe Burn Area. However, exercise control factors prevented the collection and analysis of detailed data during this portion of the exercise.

Maneuvers within the Safe Burn Area were included to assist the ISB Project Team in assessing the capabilities of these task forces, with their present level of training, to successfully “control a burn” once it had been ignited. These maneuvers are utilized during burn operations to enhance operational safety, control the rate of oil removal during the burn operations, and maximize the life of the fire boom.

These operations included:

- slowing and spreading the U-configuration (to increase the surface area of burning and hence, the rate of oil);
- the speeding up and narrowing of the U-configuration (to concentrate the oil and increase its thickness for more complete burning or simply reducing the surface area of burning to control the rate of oil removal); and
- speeding up and subsequent submersion of the oil (to extinguish the burn).

Both task forces did not appear to have any problems successfully accomplishing these maneuvers. However, due to a variety of factors relating to the control and coordination of the exercise, complete documentation of these maneuvers was not collected and analyzed by the ISB Project Team.

5.3. TASK #3 – COORDINATED TASK FORCE OPERATIONAL PROCEDURE

Finding: The duration of the work cycle for the “feeder” TF (using conventional boom, the J-release, and a 0.5-nm transit distance) was documented as requiring 75 to 90 minutes.

Note: Work cycle means the duration between one spillet acquisition to the next Spillet Acquisition. Time measurements were tracked from when the target oranges first entered the “feeder” task force’s boom opening, through the transit time to the Safe Burn Area, during the spillet release and the feeder task force’s “return” to receive another target spillet. When the next spillet of target oranges entered the boom opening, the first work cycle ended and the second cycle started.

Finding: Both TF #1 and TF #2 successfully accomplished transfer of a target spillet of oranges via the J-release.

The J-release is a maneuver that involves one of the two vessels shifting position relative to the other vessel in the designated task force. One of the vessels is designated to fall behind the other

to the extent that the boom begins to flow in a straight line behind the lead vessel and the target spillet is released to the burn task force "U"-shaped fire boom. The vessels remain connected via the tows, and the target spillet slides out of the boom, over the trailing vessel towline, and into the burn task force fire boom.

It should be noted that although both task forces successfully accomplished the J-release when they were acting as the task force that released the target spillet, TF #1 initially had some difficulty "catching" a released spillet. Since the Vessel Texas Responder is usually involved in skimming operations with no space between the vessel stern and the conventional boom, its operators initially tried to use the side of the vessel as an extension of the fire boom. This is not possible when towing fire boom, which requires at least a 200-ft. safety separation between the fire boom, with its potentially burning oil, and the vessel. To attempt to use the side of the vessel as an extension of the fire boom results in the loss of a significant portion of the target spillet between the stern of the vessel and the fire boom (where there is only the boom towline). The Vessel Texas Responder operators quickly corrected this potential problem in subsequent catches.

Finding: The transfer of a target spillet via the "towline release" technique was not attempted because of weather-induced time constraints.

The "towline release" was the second principal method the project team scheduled for evaluation. This method will be implemented during ISB Exercise #2 operations.

Finding: Alternative "sprint" techniques, used for the conventional boom "feeder" task force to return to the spill for the acquisition of another spillet were also not explored during this exercise.

Alternative techniques for getting the "feeder" task force back to the spill as rapidly as possible (in order to get another spillet) were not explored during ISB Exercise #1. They should be thoroughly investigated during subsequent exercises because of their importance as a primary area in which "feeder" task force work cycle time can be reduced.

Theoretically, if work cycle time can be safely reduced, each "feeder" task force can transport more oil to the fire boom task force for burning within the available ISB Window of Opportunity. The times required for the acquisition, transport, and release of oil spillet appear to be constrained by the undesirable consequence of oil loss if operation speeds are increased.

5.4. EXERCISE PLAN/IMPLEMENTATION

Finding: For a variety of reasons, NIIMS ICS was the correct choice for managing the systematic development and implementation of the ISB Exercise #1 Plan.

NIIMS ICS is very well suited to the overall process of event (i.e., exercise) planning and subsequent operational implementation. This is particularly true when the personnel involved with the planning and implementation of the plan are familiar with NIIMS ICS as part of their normal operational activities. Since NIIMS ICS has now been adopted throughout most of the marine spill response community, it is the rational choice as the organizational paradigm for planning and conducting these types of exercises. The success of this exercise strongly re-enforces the continued use of NIIMS ICS for all future exercises of this type.

Finding: The location and layout of the ECC at the Hilton Hotel successfully met the majority of ISB Exercise #1 requirements.

The Hilton was selected based on "line of sight" radio communications considerations, proximity of the designated exercise area, physical plant layout, and parking for the USCG Gulf Strike Team communications van. The success of this exercise re-enforces this ISB Exercise #1 decision. If economically feasible, future ISB exercises should use the same resources at the Hilton Hotel as the ECC.

Finding: The real-time video link from helicopter to the ECC provided an outstanding perspective from which shore-based personnel could view the exercise.

The video link to the Exercise Command Post, which involved the use of a Bell Long Ranger Helicopter, a USCG-trained spotter, and video/communications equipment (common within the news industry) to transmit clear, stable, at-sea activity images in real time to the Exercise Command Post, worked extremely well. Valuable information in a real-time mode was accessible at the Command Post level. Exercise participants commented that this type of technology was so successful that it should be aggressively investigated for use during actual spill responses.

Finding: The Tesoro Facility Staging Area, where all TF #1 and TF #2 vessels were berthed, was very successful at meeting ISB Exercise #1 requirements.

The Tesoro Facility serves as the normal homeport for both the TF #1 and TF #2 primary vessels. Additionally, the MSRC base, which is located at the facility, provided a very appropriate conference room for the daily ISB Exercise #1 predeployment meetings. If possible, this facility should be used as the Staging Area for subsequent ISB exercises.

Finding: Oranges worked successfully as the target spilllets for ISB Exercise #1 at-sea tasks.

Oranges were selected as the target on the basis of their good visibility, buoyancy, cost, and negligible impact on the environment. They worked very well for ISB Exercise #1 purposes, providing a distinguishable surface target for fire boom operations. The use of fluorescent dye,

while excellent for marking an initial spill location, provides no other benefits for the actual boom maneuvers. Oranges should be the preferred target spilletts during subsequent ISB exercises.

The deployment (as target spilletts) and the post-exercise recovery of the oranges worked well and appeared to exceed planners' expectations. Minimal loss occurred during the course of the exercise operations.

6. CONCLUSIONS

6.1. READY FOR ISB OPERATIONS TIME REQUIREMENTS

Galveston ISB Planners should anticipate a minimum time lag of 6 to 10 hours from Order/Activation to ISB Work Group On-Scene Ready for ISB Operations for an offshore spill located within a 16-nm transit distance from the Tesoro Facility.

Based on the findings of the exercise (i.e., start time of exercise until TF #1 and TF #2 are ready for operations = 3.75 hours), plus the estimated mobilization times provided by the exercise partners (i.e., 2 to 6 hours), a time lag of 6 to 10 hours appears to be appropriate for ISB planning purposes within this type of spill scenario.

Obviously, Galveston ISB planners would need to adjust the time estimate based on the anticipated over-the-water transit distance.

Finally, these Ready for ISB Operations times should be taken into consideration when estimating the amount of time remaining for ISB operations within the Window of Opportunity for a particular oil type and weather conditions.

6.2. INDEPENDENT TASK FORCE OPERATIONAL PROCEDURE

Galveston ISB Planners should consider the Independent Task Force Operational Procedure as a lower-priority ISB response tactic for offshore spills.

The ISB exercise program identifies three different ISB Operational Procedures that were evaluated over the course of the program. Of these operational procedures, the Independent Task Force method appears to be the lower-priority tactic for reasons that include:

- Requires the greatest amount of the more expensive fire boom. Each task force needs a fire boom.
- Requires the greatest number of highly trained personnel to handle each of the multiple burns.
- Has the greatest degree of difficulty in setting up and maintaining the multiple Safe Burn Areas required for the multiple burns.
- Has the greatest potential for worker health problems whenever a wind shift occurs that redirects the plumes over adjacent task forces.

Prior to this exercise, the viability of the Coordinated Task Force Operational Procedure, with its spillet hand-off, was in doubt. If this hand-off could not be accomplished successfully, then the Independent Task Force Operational Procedure must be pursued. However, since the spillet hand-off was successfully accomplished, and the Coordinated Task Force Operational Procedure appears viable (see next conclusion), then the Independent Task Force Operational Procedure should be moved to a lower place on the list of potential ISB Operational Procedures.

6.3. COORDINATED TASK FORCE OPERATIONAL PROCEDURE

All ISB Planners should continue to consider the Coordinated Task Force Operational Procedures as a potentially promising ISB response tactic for offshore spills.

The Coordinated Task Force Operational Procedure, which was successfully demonstrated during ISB Exercise #1, takes better advantage of the available resources within the Galveston area, specifically, the limited amount and number of the more expensive fire boom and ISB trained personnel and conventional boom and conventionally trained marine response spill personnel.

Additionally, since fewer safe burn areas must be established and maintained for the same ISB oil removal rate (as compared to the Independent Task Force Operational Procedure), ICS span of control problems are less likely to arise. Finally, IAP and site safety adjustments are minimized if wind shifts occur, with fewer burns going on at any one time.

6.4. BUILDING CONSENSUS UNDERSTANDING

Exercises such as ISB Exercise #1 are an excellent tool for acquiring and building consensus in USCG/State/Industry understanding of the strengths and weaknesses of ISB within the offshore environment.

The integration and coordination of the proper personnel and equipment resources in operational evaluations such as the ISB program provides local, state, and national response communities with an excellent opportunity to test the viability of our commonly accepted theoretical procedures in a safe and technically sound manner. This is an opportunity that no single organization could afford to take advantage of separately.

By conducting large-scale exercises in a controlled sequence, the response community, can be provided with practical results that are derived from the implementation of thoughtfully developed IAPs. In this process, regulators and industry personnel are provided with data based on actual research to test their theories, gain insights, and modify the procedure(s) together.

7. RECOMMENDATIONS

7.1. COORDINATED TASK FORCE OPERATIONAL PROCEDURE

Continue to analyze the Coordinated Task Force Operational Procedure during future ISB exercises. Specific focus should be on J-Release versus Towline Release questions and Return Sprint technique issues.

Weather constraints limited the safe operational window for ISB Exercise #1. As a result, Return Sprint options and J Release versus Towline Release comparisons were not investigated. They should be investigated in a systematic manner during subsequent ISB exercises. These issues appear to hold the greatest potential for ensuring that the work cycle time for the Coordinated Task Force Operational Procedure is minimized. This is important because the more oil that can be safely brought to the fire boom for burning (within the available Window of Opportunity), the more viable ISB becomes as a response tool within these types of offshore scenarios.

7.2. FUNNEL OPERATIONAL PROCEDURE

The investigation of the Funnel Operational Procedure should be given a high priority during the next ISB exercise.

In theory, the Funnel Operational Procedure appears to present a viable option for the Galveston area in scenarios where the oil is widespread by the time the ISB Work Group arrives on-scene.

Like the Coordinated Task Force Operational Procedure, this procedure appears to require less fire boom and more conventional boom than the Independent Task Force Operational Procedure. Weather constraints and the resulting available time prevented the Funnel Operational Procedure from being investigated and evaluated during this ISB exercise.

7.3. ACTUAL FIRE BOOM

Future ISB exercises should utilize actual fire boom in order to fully understand its operational requirements and increase the validity of exercise findings.

The first exercise did not utilize fire boom. ISB Exercise #1 used standard or conventional ocean boom during the operations. This allowed the exercise controllers, operators, and data gatherers to focus on the planned ISB task implementation, which primarily involved vessel maneuvering. Significant insights were gained into the specific ISB tasks accomplished.

However, it is time to incorporate actual fire boom into these ISB exercises. This will allow the ISB Project Team to better understand the operational requirements that should be associated with the deployment and use of actual fire boom. In addition, it will increase the probability that the insights gained during these exercises will provide the response community with valid predictions of ISB Operations under actual spill response conditions.

7.4. FUTURE ISB OFFSHORE EXERCISES

Future ISB offshore exercises should build on the ISB Project Team relationships and Lessons Learned from this exercise. Specifically, they should continue to use:

- NIIMS ICS for ISB Exercise Management
- The Hilton Hotel Exercise Control Facility
- The real-time video link from helicopter
- The Tesoro Facility as the ISB Staging Area, and
- Oranges as the target spillets (if oil cannot be used).

The ISB Project Team designed the program so that the at-sea operational testing evolved in a sequential manner and data and findings would build on the previous lessons learned. This appears to have been a valid approach. It allowed the ISB Project Team to focus on operational tasks and issues involving spillet retrieval procedures. Exercises 2 and 3 will focus on the use of fire boom and heli-torches.

The more the ISB Project Team can build on the experience and insights gained during ISB Exercise #1, the more it can focus on the new tasks and issues that will be added during ISB Exercise #2.

REFERENCES

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